

What is claimed is:

1. A drive transmission device for transmitting drive of an actuator to a driven member, the drive transmission device comprising:

an input member which is driven by the actuator;

an output member for transmitting drive of the input member and driving the driven member; and

a state switching unit for performing switching between a first state to transmit drive and a second state so as not to transmit drive in the input member and the output member;

wherein the input member and the output member are in contact with each other when the state switching unit is in the first state and in the second state.

2. The drive transmission device according to Claim 1, wherein the state switching unit is an electromagnetic clutch for generating an electromagnetic force by supplying electricity, the electromagnetic clutch bringing the input member and the output member into contact with each other with contact pressure by the electromagnetic force corresponding to an electricity supply value in the first state.

3. The drive transmission device according to Claim 1, wherein the state switching unit is an electromagnetic clutch for generating an electromagnetic force by supplying

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electricity, the electromagnetic clutch bringing the input member and the output member into contact with each other with contact pressure by the electromagnetic force corresponding to an electricity supply value in the second state.

4. The drive transmission device according to Claim 1, wherein the actuator is a motor.

5. The drive transmission device according to Claim 1, wherein the input member has an input contact surface, and the output member has an output contact surface to come in contact with the input contact surface.

6. The drive transmission device according to Claim 5, wherein a lubricant to give slidability is applied onto the input contact surface and onto the output contact surface.

7. The drive transmission device according to Claim 6, wherein the lubricant is grease.

8. The drive transmission device according to Claim 5, wherein at least one of either the input contact surface or the output contact surface is treated with electrolytic plating or electroless plating to give slidability.

9. The drive transmission device according to Claim 8, wherein a lubricant to give slidability is applied onto the contact surface.

10. The drive transmission device according to Claim 9, wherein the lubricant is grease.

11. The drive transmission device according to Claim 5, wherein an intermediate member to give slidability is provided between the input contact surface and the output contact surface.

12. The drive transmission device according to Claim 11, wherein the intermediate member is made of at least one of either Teflon or polyethylene.

13. An optical apparatus including a drive transmission device for transmitting drive so as to manually drive an optical member by manually operating a manual-drive member and so as to electrically drive the optical member by transmitting electric drive from an actuator to the manual-drive member, the optical apparatus comprising:

an optical unit which movably supports the optical member driven by the manual-drive member;

an input member driven by the actuator;

an output member for transmitting drive of the input member and driving the manual-drive member; and

a state switching unit for performing switching between a first state to transmit drive and a second state so as not to transmit drive in the input member and the output member;

wherein the input member and the output member are in contact with each other when the state switching unit is in the first state and in the second state.

14. The optical apparatus according to Claim 13, wherein the state switching unit is an electromagnetic clutch for generating an electromagnetic force by supplying electricity, the electromagnetic clutch bringing the input member and the output member into contact with each other with contact pressure by the electromagnetic force corresponding to an electricity supplying value in the first state.
15. The optical apparatus according to Claim 13, wherein the optical member is a zoom lens unit.
16. The optical apparatus according to Claim 13, wherein the optical member is a focus lens unit.
17. The optical apparatus according to Claim 13, wherein the optical member is a stop unit.
18. The optical apparatus according to Claim 13, wherein the actuator is a motor.
19. The optical apparatus according to Claim 13, wherein the input member has an input contact surface, and the output member has an output contact surface to come in contact with the input contact surface.
20. The optical apparatus according to Claim 19, wherein a lubricant to give slidability is applied onto the input contact surface and onto the output contact surface.
21. The optical apparatus according to Claim 20, wherein the lubricant is grease.
22. The optical apparatus according to Claim 19, wherein at

least one of either the input contact surface or the output contact surface is treated with electrolytic plating or electroless plating to give slidability.

23. The optical apparatus according to Claim 22, wherein a lubricant to give slidability is applied onto the contact surface.

24. The optical apparatus according to Claim 23, wherein the lubricant is grease.

25. The optical apparatus according to Claim 19, wherein an intermediate member to give slidability is provided between the input contact surface and the output contact surface.

26. The optical apparatus according to Claim 25, wherein the intermediate member is made of at least one of either Teflon or polyethylene.

27. The optical apparatus according to Claim 14, further comprising a controller for controlling an electricity supplying value for the electromagnetic clutch so as to vary contact pressure between the input member and the output member.

28. An optical apparatus including a drive transmission device for transmitting drive so as to manually drive an optical member by manually operating a manual-drive member and so as to electrically drive the optical member by transmitting electric drive from an actuator to the manual-drive member, the optical apparatus comprising:

an optical unit which movably supports the optical member driven by the manual-drive member;

an input member driven by the actuator;

an output member for transmitting drive of the input member and driving the manual-drive member;

a state switching unit for performing switching between a first state to transmit drive and a second state so as not to transmit drive in the input member and the output member;

a command unit for commanding the optical member to be electrically driven, the command unit outputting command information in accordance with operation of a command operating member to the actuator; and

a controller for controlling the state switching unit in accordance with the command information from the command unit;

wherein the input member and the output member are in contact with each other when the state switching unit is in the first state and in the second state.

29. The optical apparatus according to Claim 28, wherein the controller brings the state switching unit into the first state when there is no command information from the command unit or when command information does not exceed a predetermined range, whereas the controller brings the state switching unit into the second state when there is command

information from the command unit or when command information exceeds the predetermined range.

30. The optical apparatus according to Claim 28, wherein the state switching unit is an electromagnetic clutch for generating an electromagnetic force by supplying electricity, the electromagnetic clutch bringing the input member and the output member into contact with each other with contact pressure by the electromagnetic force corresponding to an electricity supply value, and the controller controls an electricity supply value for the clutch in accordance with command information from the command unit.

31. The optical apparatus according to Claim 30, wherein the controller brings the electromagnetic clutch into a state of non-electricity supply when there is no command information from the command unit or when command information does not exceed a predetermined range, whereas, when there is command information from the command unit or when command information exceeds the predetermined range, the controller brings the electromagnetic clutch into a state of electricity supply and sets an electricity supply value for the electromagnetic clutch at an electricity supply value according to the command information.

32. The optical apparatus according to Claim 28, wherein the command unit has an operating member operated for

commanding the optical member to be electrically driven, and the actuator that outputs command information in accordance with operation of the operating member works at a speed corresponding to the command information that varies in accordance with an operational amount of the operating member.

33. The optical apparatus according to Claim 28, wherein the optical member is a zoom lens unit.
34. The optical apparatus according to Claim 28, wherein the optical member is a focus lens unit.
35. The optical apparatus according to Claim 28, wherein the optical member is a stop unit.
36. The optical apparatus according to Claim 28, wherein the command information is a zoom driving signal.
37. The optical apparatus according to Claim 28, wherein the command information is a focus driving signal.
38. The optical apparatus according to Claim 28, wherein the command information is a stop driving signal.
39. The optical apparatus according to Claim 28, wherein the actuator is a motor.
40. The optical apparatus according to Claim 28, wherein the input member has an input contact surface, and the output member has an output contact surface to come in contact with the input contact surface.
41. The optical apparatus according to Claim 40, wherein a

lubricant to give slidability is applied onto the input contact surface and onto the output contact surface.

42. The optical apparatus according to Claim 41, wherein the lubricant is grease.

43. The optical apparatus according to Claim 40, wherein at least one of either the input contact surface or the output contact surface is treated with electrolytic plating or electroless plating to give slidability.

44. The optical apparatus according to Claim 43, wherein a lubricant to give slidability is applied onto the contact surface.

45. The optical apparatus according to Claim 44, wherein the lubricant is grease.

46. The optical apparatus according to Claim 40, wherein an intermediate member to give slidability is provided between the input contact surface and the output contact surface.

47. The optical apparatus according to Claim 46, wherein the intermediate member is made of at least one of either Teflon or polyethylene.

48. The optical apparatus according to Claim 30, wherein the controller controls an electricity supply value for the electromagnetic clutch so as to satisfy the relation:

$$Tk' < Td' < Tm$$

where  $Tm$  is a maximum driving torque occurring at the input member driven by the actuator,  $Tk'$  is driving-torque needed

to drive the output member that drives the optical member through the manual-drive member, and  $Td'$  is engagement torque corresponding to contact pressure between the input member and the output member.

49. The drive transmission device according to Claim 48, wherein the controller controls an electricity value for the electromagnetic clutch so as to satisfy the relation:

$$Td' < Tsy'$$

where  $Tsy'$  is manual driving torque transmitted from the manual-drive member to the output member through manual operation when the optical member is electrically driven by the actuator, thereby allowing the optical member to be manually driven while being electrically driven.

50. The optical apparatus according to Claim 30, wherein, when the optical member is not electrically but manually driven, the controller controls an electricity supply value for the electromagnetic clutch so as to satisfy the relation:

$$0 \leq Td'' < Tk'$$

where  $Tk'$  is driving torque needed to drive the output member that drives the optical member through the manual-drive member while being electrically driven, and  $Td''$  is engagement torque corresponding to contact pressure between the input member and the output member when manually driven.

51. The optical apparatus according to Claim 50, wherein

the controller controls an electricity supply value for the electromagnetic clutch so as to satisfy the relation:

$$0 < T_d'' < T_k'.$$

52. The optical apparatus according to Claim 30, further comprising an adjusting member operated to vary engagement torque of the electromagnetic clutch, wherein the controller controls an electricity supply value for the electromagnetic clutch in accordance with operation of the adjusting member and varies the engagement torque when the optical member is manually operated.

53. The optical apparatus according to Claim 30, wherein the controller controls an electricity supply value for the electromagnetic clutch in accordance with operation of the manual-drive member by a user.

54. An optical apparatus including a drive transmission device for transmitting drive so as to manually drive an optical member by manually operating a manual-drive member and so as to electrically drive the optical member by transmitting electric drive from an actuator to the manual-drive member, the optical apparatus comprising:

an optical unit that movably supports the optical member driven by the manual-drive member;

an imaging unit to which the optical unit is detachably mounted, the imaging unit having an image pickup device for picking up a subject image from the optical unit;

an input member driven by the actuator;

an output member for transmitting drive of the input member and driving the manual-drive member;

a state switching unit for performing switching between a first state to transmit drive and a second state so as not to transmit drive in the input member and the output member;

a command unit for commanding the optical member to be electrically driven, the command unit outputting command information in accordance with operation of a command operating member to the actuator; and

a controller for controlling the state switching unit in accordance with the command information from the command unit;

wherein the input member and the output member are in contact with each other when the state switching unit is in the first state and in the second state.

55. An optical-apparatus driving unit mounted or connected to a body of an optical apparatus including an optical member, the optical-apparatus driving unit including a drive transmission device in which the optical member can be manually operated by manual operation input to a manual-drive member and in which the optical member can be electrically driven by transmitting electric drive from an actuator to the manual-drive member, the optical-apparatus

driving unit comprising:

an input member driven by the actuator;

an output member for transmitting drive of the input member and driving the manual-drive member;

a state switching unit for performing switching between a first state to transmit drive and a second state so as not to transmit drive in the input member and the output member;

a command unit for commanding the optical member to be electrically driven, the command unit outputting command information in accordance with operation of a command operating member to the actuator; and

a controller for controlling the state switching unit in accordance with the command information from the command unit;

wherein the input member and the output member are in contact with each other when the state switching unit is in the first state and in the second state.